

What is claimed is:

1 1. A light emitting apparatus, comprising:
2 a light emitting element with an emission wavelength in
3 the range of 360 to 550 nm; and
4 a rare-earth element doped oxide nitride phosphor;
5 wherein part of light radiated from the light emitting
6 element is wavelength-converted by the phosphor.

1 2. The light emitting apparatus according to claim 1,
2 wherein;
3 the emission wavelength is in the range of 450 to 550 nm,
4 and the light emitting apparatus radiates white light generated
5 by a mixture of the wavelength-converted light and the other
6 part of light radiated from the light emitting element.

1 3. The light emitting apparatus according to claim 1,
2 wherein;
3 the oxide nitride phosphor is of oxide nitride that
4 contains α -sialon as matrix material.

1 4. The light emitting apparatus according to claim 1,
2 wherein;
3 the phosphor is in the form of powder or particles and
4 is contained in a light transmitting material.

1 5. The light emitting apparatus according to claim 1,
2 wherein;
3 the light emitting element is III group nitride system
4 compound semiconductor emitting element.

1 6. The light emitting apparatus according to claim 1,
2 wherein;
3 the phosphor is represented by a general formula:
4 $\text{Me}_x\text{Si}_{12-(m+n)}\text{Al}_{(m+n)}\text{O}_n\text{N}_{16-n}:\text{Re}_1\text{Re}_2$, part or all of metal (Me), where
5 Me is one or more of Li, Ca, Mg, Y and lanthanide metals except
6 for La and Ce, to be dissolved into α -sialon being replaced
7 by lanthanide metal (Re1), where Re1 is one or more of Ce, Pr,
8 Eu, Tb, Yb and Er, as luminescence center, or replaced by
9 lanthanide metal (Re1) and lanthanide metal (Re2), where Re2
10 is Dy, co-activator.

1 7. The light emitting apparatus according to claim 6,
2 wherein;
3 the phosphor satisfies, when the metal (Me) is bivalent,
4 $0.6 < m < 3.0$ and $0 \leq n < 1.5$ in the general formula.

1 8. The light emitting apparatus according to claim 6,
2 wherein;
3 the phosphor satisfies, when the metal (Me) is trivalent,

4 $0.9 < m < 4.5$ and $0 \leq n < 1.5$ in the general formula.

1 9. The light emitting apparatus according to claim 6,
2 wherein;

3 the phosphor is $\text{Me}_x\text{Si}_{9.75}\text{Al}_{2.25}\text{O}_{0.75}\text{N}_{15.25}:\text{Re}_y\text{Re}_2_z$ to satisfy
4 $m=1.5$ and $n=0.75$ in the general formula, where $0.3 < x+y < 0.75$ and
5 $0.01 < y+z < 0.7$, where $y > 0.01$, $0.0 \leq z < 0.1$, are satisfied.

1 10. The light emitting apparatus according to claim 6,
2 wherein;

3 the phosphor is $\text{Me}_x\text{Si}_{9.75}\text{Al}_{2.25}\text{O}_{0.75}\text{N}_{15.25}:\text{Re}_y\text{Re}_2_z$ to satisfy
4 $m=1.5$ and $n=0.75$ in the general formula, where $0.3 < x+y+z < 1.5$,
5 $0.01 < y < 0.7$ and $0.0 \leq z < 0.1$ are satisfied.

1 11. The light emitting apparatus according to claim 6,
2 wherein;

3 the metal (Me) is calcium (Ca).

1 12. The light emitting apparatus according to claim 1,
2 wherein;

3 the phosphor is sialon system phosphor powder that is
4 composed of: α -sialon of 40 weight% or more and 90 weight% or
5 less, the α -sialon being structured such that Ca site of Ca-
6 α -sialon represented by: $(\text{Ca}_x, \text{M}_y)(\text{Si}, \text{Al})_{12}(\text{O}, \text{N})_{16}$ is partially
7 replaced by metal (M): β -sialon of 5 weight% or more and 40

8 weight% or less; and unreacted silicon nitride of 5 weight% or
9 more and 30 weight% or less, where M is metal that is one or
10 more selected from Ce, Pr, Eu, Tb, Yb and Er and $0.05 < (x+y) < 0.3$,
11 $0.02 < x < 0.27$ and $0.03 < y < 0.3$.

1 13. The light emitting apparatus according to claim 12,
2 wherein:

3 the entire phosphor powder has a chemical composition
4 that is in the range of three composition lines of $\text{Si}_3\text{N}_4\text{-a}(\text{M}_2\text{O}_3 \cdot$
5 $9\text{AlN})$, $\text{Si}_3\text{N}_4\text{-b}(\text{CaO} \cdot 3\text{AlN})$ and $\text{Si}_3\text{N}_4\text{-c}(\text{AlN} \cdot \text{Al}_2\text{O}_3)$, where
6 $4 \times 10^{-3} < a < 4 \times 10^{-2}$, $8 \times 10^{-3} < b < 8 \times 10^{-2}$ and $10^{-2} < c < 8 \times 10^{-1}$ are satisfied.

1 14. A light emitting apparatus, comprising:
2 a light emitting element with an emission wavelength in
3 the range of 360 to 550 nm; and
4 a cerium ion doped lanthanum silicon nitride phosphor;
5 wherein part of light radiated from the light emitting
6 element is wavelength-converted by the phosphor.

1 15. The light emitting apparatus according to claim 14,
2 wherein:

3 the phosphor is represented by: $\text{La}_{1-x}\text{Si}_3\text{N}_5\text{:xCe}$, where
4 doping amount x is $0 < x < 1$ and cerium ion is doped to lanthanum
5 site in solid dissolution replacement.

1 16. The light emitting apparatus according to claim 14,
2 wherein:

3 the doping amount x is $0.1 < x < 0.5$ and the phosphor is
4 ultraviolet ray excitation phosphor.

1 17. The light emitting apparatus according to claim 14,
2 wherein:

3 the doping amount x is $0.0 < x < 0.2$, and the phosphor is
4 electron beam excitation phosphor.

1 18. The light emitting apparatus according to claim 14,
2 wherein:

3 the phosphor radiates blue light.

1 19. A light emitting method for a light emitting apparatus
2 that comprises a light emitting element with an emission
3 wavelength in the range of 360 to 550 nm and a rare-earth element
4 doped oxide nitride phosphor, wherein part of light radiated
5 from the light emitting element is wavelength-converted by the
6 phosphor, and the light emitting apparatus radiates light
7 generated by a mixture of wavelength-converted light and the
8 other part of light radiated from the light emitting element,
9 comprising the step of:
10 turning on intermittently the light emitting element.

1 20. A light emitting method for a light emitting apparatus
2 that comprises a light emitting element with an emission
3 wavelength in the range of 360 to 550 nm and a cerium ion doped
4 lanthanum silicon nitride phosphor, wherein part of light
5 radiated from the light emitting element is
6 wavelength-converted by the phosphor, and the light emitting
7 apparatus radiates light generated by a mixture of
8 wavelength-converted light and the other part of light radiated
9 from the light emitting element, comprising the step of:
10 turning on intermittently the light emitting element.

1 21. The light emitting method according to claim 19,
2 wherein:
3 the color of the light radiated from the light emitting
4 apparatus is adjusted by controlling the turn-on time of the
5 light emitting element.

1 22. The light emitting method according to claim 20,
2 wherein:
3 the color of the light radiated from the light emitting
4 apparatus is adjusted by controlling the turn-on time of the
5 light emitting element.

1 23. The light emitting method according to claim 19,
2 wherein:
3 the emission wavelength is in the range of 450 to 550 nm,

4 and the light emitting apparatus radiates white light.

1 24. The light emitting method according to claim 20,
2 wherein:

3 the emission wavelength is in the range of 450 to 550 nm,
4 and the light emitting apparatus radiates white light.

1 25. The light emitting apparatus according to claim 19,
2 wherein;

3 the light emitting element is III group nitride system
4 compound semiconductor emitting element.

1 26. The light emitting apparatus according to claim 20,
2 wherein;

3 the light emitting element is III group nitride system
4 compound semiconductor emitting element.